
A Diabetes Control Program in a Public Health Care Setting

SUSAN B. BAKER, PhD, MPH
CARLOS VALLBONA, MD
VALORY PAVLIK, MEd, MPH
CARL E. FASSER, BA, PA-C
MARY ARMBRUSTER, MS, RN, CDE
REGINA McCRAY, BSN, RN
ROBERT L. BAKER, MS

Dr. Baker is Assistant Professor in the Department of Community Medicine, Baylor College of Medicine, and Co-Principal Investigator and Director of the Diabetes Control Program (DCP). Dr. Vallbona is Professor and Chairman of the Department of Community Medicine and Principal Investigator of the DCP. Ms. Pavlik, Mr. Fasser, and Mr. Baker are faculty members of the Department of Community Medicine. Ms. Pavlik is Coordinator and Evaluator of the education programs and, because she was raised in an Hispanic environment and is bilingual, is consultant for the Spanish language needs of the program. Mr. Fasser is a Consultant for medical care and patient education protocol development. Ms. Armbruster is Coordinator for the diabetes patient education program in the community health centers. When this study was conducted, Ms. McCray was Director of Nursing for the Harris County Hospital District Community Health Program and developed protocols for patient education and expanded role nursing care. She is now Director of Quality Management Services for Ambulatory Care. Mr. Baker is Consultant for economic evaluation.

Lila Laux, PhD, contributed psychosocial research and education to the program, and Christine Higgins, BS, provided research assistance. Both are with Baylor's Department of Community Medicine.

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Tearsheet requests to Susan Baker, PhD, MPH, Department of Community Medicine, Baylor College of Medicine, Houston, TX 77030, telephone 713-798-3606.

Synopsis.....

The Houston Diabetes Control Program is part of an effort by the State of Texas and approximately 30 other programs throughout the United States to ensure that persons with diabetes-related complications receive ongoing state-of-the-art preventive care and treatment. For the past 5 years, this program has served an urban, high-risk patient population with special cultural, ethnic, and economic challenges.

The intervention has included the development and implementation of protocols for the prevention and care of diabetes-related complications of the eyes, lower extremities, and cardiovascular system, as well as general management of diabetes and patient and professional education. The program is ongoing in nine community health centers located in low-income neighborhoods of a large metropolitan area. The results thus far indicate an increase in sensitive eye examinations from 8 percent to 26 percent of the patient population, a reduction in incidence of legal blindness from 9.5 to 2.7 per 1,000 during a 4-year period, an increase in foot examinations from 18 percent to 44 percent of the patient population, and 77 percent of hypertensive patients in good control of blood pressure at less than 160 over 95 mmHg (millimeters of mercury).

On the average, there have not been significant long-term improvements in weight reduction or blood glucose control. The major challenges for this program are (a) improvement in control of glycemia, hypertension, and cholesterol; (b) more effective diet and physical activity interventions; and (c) more effective education approaches that help patients to understand metabolic and cardiovascular functions. These challenges will require collaboration of health care professionals in constructive and imaginative ways through their unselfish commitment toward common goals.

IN 1974, Congress passed the National Diabetes Mellitus Research and Education Act, which established the National Commission on Diabetes to

develop a long-range plan of attention for this disorder. The plan included the formation of the Diabetes Control Program (DCP) of the Centers

for Disease Control “to design and implement coordinated community initiatives for overcoming barriers to effective diabetes care and treatment” (1).

In 1987, the National Diabetes Advisory Board (NDAB) issued a revised long-range plan that recommended “opportunities for translation of available research information into clinical care to reduce the burden that diabetes places on the Nation.” The Board’s recommendations responded to “a marked shift in national health care philosophy from treatment of disease to prevention of disease and reduction of avoidable complications” (1).

In 1986, the Texas Department of Health selected the community health program of the Harris County Hospital District (HCHD) in Houston to be one of several diabetes translation sites throughout the United States that were supported through cooperative agreements with the Centers for Disease Control. The intent of this cooperative agreement was to reduce diabetes-related morbidity and premature mortality and integrate complication-specific elements into a comprehensive program of health care delivery.

The complications of diabetes that have been the major focus of the DCP in Houston for the previous 5 years are diabetes-related eye disease, prevention of foot complications and lower extremity amputations, and control of cardiovascular disease and hypertension. Prevention of adverse outcomes of pregnancy is also considered a high priority for this program, even though patients with high-risk pregnancies are referred to hospital-based clinics outside the structure of the community-based health centers. The goals established by the NDAB for these diabetes-related complications are as follows (1):

- Reduce the incidence of legal blindness.
- Reduce the incidence of lower extremity amputations.
- Increase the rate of controlled hypertension.
- Reduce the prevalence of cigarette smoking.
- Reduce the mean serum cholesterol level.
- Achieve clinically significant weight loss.

To address these goals, the Houston DCP developed interdisciplinary diabetes interventions for the targeted complications as well as patient and professional education. In this paper, we report on the patient management protocols for the DCP program, the evaluation approach, and the results obtained to date.

Setting

The Houston DCP has been integrated into the routine care program of nine community health centers located in low-income neighborhoods of a large metropolitan area. The HCHD provides services for approximately 206,000 county residents, of whom 133,000 are active users of the community health centers. The remaining 73,000 patients use only the emergency centers, hospitals, or hospital-based clinics for primary health care.

The staff of the community health centers includes 55 full-time equivalent physicians and physician assistants from the Department of Community Medicine of Baylor College of Medicine and from the Department of Family and Community Medicine of the University of Texas Health Science Center in Houston, 66 nurses, 8 dietitians, 4 social workers, and 41 other health care professionals. Podiatric patient care and educational services in the community health centers are provided by two podiatrists and eight podiatry residents (total of .5 full-time equivalents) through a contract between Baylor’s Department of Community Medicine and a private podiatry association.

The community health centers’ patient population with diabetes mellitus consists of approximately 4,300 active users, of whom 97 percent have noninsulin-dependent diabetes mellitus (NIDDM) and 3 percent insulin-dependent diabetes mellitus (IDDM). The prevalence of diabetes in patients 45 years and older is 12 percent; for patients 65 and older, the prevalence is 20 percent. The ethnic distribution of the NIDDM population is 53 percent African American, 30 percent Hispanic, 16 percent white, and 1 percent Asian. The mean age of this population, which is 71 percent female, is 60 years (standard deviation \pm 12.47).

The following is a description of the patient management protocols used in the nine community health centers. These protocols have been developed by the Houston DCP for the management of diabetes-related eye disease, foot complications, cardiovascular risk factors, and general management. Also, curriculums have been developed for diabetes-related patient and professional education.

Diabetes-Related Eye Disease Objectives

- Develop and implement a protocol providing recommendations for primary care physicians for the prevention and care of diabetes-related eye disease and referral to the ophthalmologist for diagnosis and treatment.

- Provide resources for treatment and followup of diabetic eye disease.

In 1987, a protocol for diabetes-related disease screening and detection was developed in cooperation with the Baylor Department of Ophthalmology. It specifies referral to the ophthalmologist or optometrist based on abnormal fundus or visual acuity criteria. The referral criteria and treatment algorithm are based on the American Academy of Ophthalmology's recommendations that all NIDDM patients should have an initial dilated eye examination for diabetic retinopathy as soon after diagnosis as possible and yearly thereafter (2).

Foot Complications Objectives

- Develop and implement a protocol providing recommendations for primary care physicians for the prevention and care of foot complications and referral to the podiatrist or neurovascular and orthopedic services for consultation and treatment.
- Provide resources for treatment and followup of foot complications and lower extremity amputations.

The Houston DCP for diabetes foot care was implemented in 1989 to ensure that every person with NIDDM receives a careful foot examination at least once a year and is treated appropriately. The guidelines specify that all NIDDM patients remove their footwear and that a nurse performs a risk assessment for foot complications at the time vital signs are taken. A medical evaluation is to be performed by the primary care physician following guidelines on the diabetes foot assessment form (copies available from Dr. Baker). If there are foot problems, or other educational needs, the physician is to refer the patient to the podiatrist or diabetes educators. If there are cases of foot deformity that cannot be conservatively treated (for example, severe bunions or metatarsal head prominence), the patient is referred to the Ben Taub Orthopedic Foot Clinic. Cases involving significant vascular compromise are referred to the Ben Taub Surgery Clinic.

Cardiovascular Risk Factors Objectives

- Develop and implement a diabetes-related protocol for hypertension and cardiovascular screening and treatment by primary care physicians.
- Develop and implement a protocol for management of dyslipidemia in diabetes.

'In 1987, a protocol for visual impairment screening and detection was developed in cooperation with the Baylor Department of Ophthalmology. It specifies referral to the ophthalmologist or optometrist based on abnormal fundus or visual acuity criteria.'

- Use existing resources in the community health centers to reduce risk factors in persons with diabetes, including smoking cessation, weight control, and exercise.

In 1974, a demonstration program was established to substantiate the effectiveness of using a standardized protocol for early detection, diagnosis, treatment, and management of hypertension (3). This protocol was adapted in 1987 for use with the NIDDM population with hypertension, including incorporation of new pharmacological agents. An expanded nursing protocol has also been developed for the management of patients with diabetes or hypertension. It defines the role of the professional nurse in the community health centers to include specific case loads of patients referred from the primary care physician.

The DCP also provides guidelines for the management of dyslipidemia because of its high prevalence in persons with diabetes and its contribution to atherosclerotic heart disease. The recommendations are based on the National Cholesterol Education Program Adult Treatment Panel (4), with minor modifications. Since persons with diabetes are much more likely than others to have hypertriglyceridemia and low HDL (high-density lipoprotein) levels, the protocol recommends an annual lipid profile, including total cholesterol, triglycerides, and HDL.

Management of Diabetes Mellitus Objective

- Develop and implement a protocol for the detection and management of NIDDM and IDDM, to include early detection and control of impaired glucose tolerance, weight control, and physical activity.

Different approaches to management by physicians and other health care providers are based on

Table 1. Costs of 12 months' treatments for diabetic eye disease, 1990-91

Category	Cases	Cost per treatment	Total
Screening:			
Primary care physicians and optometrists	533	\$30	\$15,990
Ophthalmologists ¹	1,160	...	...
Total screening examinations ²	1,693	...	...
Treatments:			
Photocoagulation	64	3,864	247,296
Photocoagulation for macular edema	10	4,830	48,300
Vitrectomy	2	5,200	10,400
Glaucoma medications ³	127	7,040	894,080
Cataract surgery	31	5,400	167,400
Project costs .....	...	...	78,727
Total costs .....	...	...	1,462,193

¹ Screening costs included with treatment costs.

² 1,577 patients received 1,693 examinations.

³ Annual rate for average of 10 years adjusted for drug inflation rate of 11 percent and dollar discount of 7 percent.

the individualized needs of their patients. However, physicians are required to be familiar with the treatment guidelines that were developed in cooperation with the Baylor Department of Medicine, which follow the American Diabetes Association's clinical procedures recommendations and represent the current state-of-the-art in management of NIDDM (5,6). These guidelines include a flow diagram for classification of diabetes mellitus in adults (that is, impaired glucose tolerance, IDDM, NIDDM, gestational diabetes), a step-care plan for medication treatment based on degree of obesity and blood glucose level, and a management protocol for asymptomatic patients. The decision-making algorithms used as guidelines for management of NIDDM patients are available from Dr. Baker.

Patient Education Objectives

- Develop and implement a culturally sensitive curriculum for patient instruction that will increase knowledge, skills, and self-management abilities.
- Develop models of diabetes education that can be replicated in other settings.

A curriculum for patient education was developed in accordance with national standards set for diabetes patient education programs (7) and by the NDAB (8). This curriculum is based on the premise that patients with NIDDM can assume a major share of responsibility for their own care and take an active role in self-management. It involves lectures and demonstrations enhanced by visual and

printed teaching aids, participant discussion, and individualized counseling and assessments.

The curriculum consists of four 2-hour sessions conducted by the diabetes nurse educator and a nutritionist. The modules consist of the following topics: "What is Diabetes?" "Food and Exercise," "Medicine and Sick Days," and "Low Blood Sugar and Good Health Habits." The instruction manual includes learner objectives, learning content, review questions in English and Spanish with correct answers, and a posttest (9).

All patient participants receive a notebook with pocket dividers containing handout materials related to each class. After the last class, the patient is given a certificate of completion and a canvas bag designed for this program with the inscription, "I'm in Control." Supplemental materials for the program include handouts developed by community health center professionals, as well as materials developed by pharmaceutical companies, other diabetes control programs, and the Pennsylvania Diabetes Academy (10,11). Other materials developed by the Houston DCP to motivate the patients toward self-management include handouts and posters—"Patient Rights and Responsibilities," "Facts About Pregnancy" (adapted from the Washington State DCP) (12).

Professional Education Objective

- Provide routine continuing medical education for physicians and other members of the health care team, related to the care of patients with diabetes.

Professional education is accomplished through diabetes-related self-study kits (11,13), yearly seminars, and one-on-one training provided by internists, ophthalmologists, podiatrists, and certified diabetes educators. A monetary incentive is provided to all nurses who become certified diabetes educators.

Evaluation

Complications. This program monitors the accomplishment of objectives related to outcome for diabetes-related eye disease, foot complications, cardiovascular disease and hypertension, impaired glucose tolerance, and patient and professional education. The effectiveness of the patient care protocols has been assessed in terms of the (a) blood glucose level and weight of a sample cohort of patients followed over a 3-year period, (b) prevalence of uncontrolled hypertension and dyslipide-

mia in a cohort and a cross-sectional sample studied on a yearly basis, (c) number of persons receiving dilated eye examinations and followup treatment, (d) incidence rate of blindness on a cohort of patients followed during a 4-year period, and (e) number of persons receiving foot examinations and hospitalizations for foot complications and the rate of amputations. In addition, once a year demographic and anthropometric measures are documented on a cross-sectional random sample of 10 percent of the active patient population.

Patient education. The effectiveness of the patient education program has been evaluated primarily through knowledge tests and studies of the average blood glucose levels of a sample of patients who completed the curriculums described previously.

Professional education. The professional education program has been assessed through chart reviews by peers and knowledge and proficiency assessments of visual impairment.

Data base. Since the HCHD health care delivery system does not have a computerized medical record data base describing patient encounters, patient charts are reviewed individually to obtain information required for program and outcome evaluation.

Results

Diabetes-related eye disease examinations and impact. Before the inception of the DCP in 1986, there was less than one full-time equivalent ophthalmologist available for diabetic eye disease screening and detection. Only 8 percent of the NIDDM patients were examined during 1986. In fiscal year 1991-92, even though ophthalmology resources were at the same level, with the help of primary care physicians and optometrists, 26 percent of the total NIDDM patient population were screened for diabetic eye disease, and the numbers continue to increase. Of the patients who received dilated eye examinations, 58 percent were diagnosed with diabetic eye disease, and of those diagnosed, 37 percent were scheduled for treatment, of whom 78 percent had received treatment at the end of the fiscal year.

A study of the program's impact on blindness incidence was conducted on a random cohort sample of 1,164 patients selected in 1986 and followed through 1989, when there were 744 patients remaining in the program. The results

Table 2. Benefits of 12 months' treatments for diabetic eye disease, 1990-91

Treatment	Cases	Benefit per treatment	Total benefits
Photocoagulation	64	\$3,038	\$194,432
Photocoagulation-macular edema	10	1,697	16,970
Vitrectomy	2	3,038	6,076
Glaucoma medications	127	48,462	6,154,674
Cataract surgery	31	48,462	1,502,322
Total . . . . .	...	...	7,874,474

Table 3. Benefits and costs for 12 months' treatments for diabetic eye disease, 1990-91

Benefits and costs	100 percent benefits	50 percent benefits for glaucoma and cataracts
Benefits	\$7,874,474	\$4,045,976
Costs	1,462,193	1,462,193
Net benefit	6,412,281	2,583,783
Benefit to cost ratio =	5.39	2.77

showed decreases from 9.5 per 1,000 (95 percent confidence interval of 4.7 to 16.8) in 1986 to 2.7 per 1,000 in 1989 (confidence interval of .33 to 9.7). Although the confidence intervals around the incidence rate do not indicate statistical significance, the decrease in the incidence of blindness is considered to be encouraging, clinically.

Cost savings from eye disease prevention. In addition to studies of the process and outcome, tables 1-3 provide a summary of the results of a study to determine potential cost savings resulting from the diabetic eye disease prevention program (14). Cost estimates and benefits were based on studies reported in the literature (15-18). Program costs include screening and treatment costs for diabetic eye disease (that is, photocoagulation, vitrectomy, glaucoma medications, cataract surgery) and administrative costs of the DCP. The benefits are described in terms of dollars saved by society from Social Security Disability Insurance and Supplemental Security Income, with the long-term stream of expected years of disability discounted to the present value. Since patients who are treated have a low, but not zero, probability of going blind, the benefit value is the difference in expected disability payment stream values with and without treatment.

Many costs were omitted (for example, out-of-pocket costs, costs of complications of cataract surgery, costs of treating glaucoma surgically rather

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than with medications). Similarly, not all benefits were included (for example, costs not experienced from surgery complications and lost productivity). Also, it was estimated that about 50 percent of the program participants would have received screening for glaucoma and cataracts even without the diabetes program. Thus, table 3 provides two benefit-cost ratios: the ratio of 5.39 assumes 100 percent benefits from the program; the ratio of 2.77 assumes 100 percent photocoagulation benefits but 50 percent glaucoma and cataract benefits. Even with the reduction, the relative magnitude of the numbers suggests that substantial benefits can be obtained through preventive measures such as those undertaken at the nine community health centers.

Foot complications and lower extremity amputations. During the year prior to the DCP foot prevention program, 18 percent of the patients at high risk for foot complications had foot care examinations. In 1991, 44 percent of high-risk patients had their feet examined. Twenty-one percent of these patients were found to have foot ulcers. In addition to the dramatic increase in foot examinations, substantiation of the program's success is provided by recent incorporation of podiatry services into the budgeted HCHD community health program.

Cardiovascular risk factors. The prevalence of diagnosed hypertension in the NIDDM patients is 68 percent, with the highest prevalence in African Americans and the lowest in Hispanics. A chart review of 3,039 patients with hypertension and diabetes who visited a community health center two or more times during July 1990 to June 1991 showed that the average blood pressure was below 160/95 mmHg (millimeters of mercury) in 77 percent and below 140/90 mmHg in 40 percent. Women

younger than 65 years are better controlled than men, but after age 65, control rates in men and women are comparable. Hispanic women have the best rate of control overall.

With the incorporation of a new protocol for the management of dyslipidemia in diabetes, the goals for treatment include lowering non-HDL cholesterol (LDL [low-density lipoprotein] and VLDL [very low-density lipoprotein]). However, for 1991 only data on total cholesterol are available on enough patients for reporting purposes. The average fasting plasma cholesterol level of control was below 200 milligrams per deciliter (mg per dl) in 47 percent and below 240 mg per dl in 65 percent of the diabetes population. A report of the level of smoking is unavailable since it is not consistently documented in all charts.

Hyperglycemia. The ability to control blood glucose in diabetic patients is not as effective as the ability to control hypertension. A study was conducted on a sample of 274 NIDDM patients seen before and after program implementation. These patients had at least two recorded fasting plasma glucose (FPG) values per year during a 3-year period in order to assess the impact of the standardized diagnosis, management, and education protocols (19). Of this group, 80 percent had received dietary counseling, and 46 percent had attended group education classes. The level of blood glucose control before and 2 years after implementation of the DCP protocols of care management is shown in table 4. There are no statistically significant changes in the level of FPG.

One year after implementation of the care management protocol, the treatment intensity (that is, change in type of medication or higher dosage) increased in 70 percent of the patients who were in fair or poor control, but only 22 percent improved their levels of control (that is, fair to good 11 percent; poor to fair 8 percent; poor to good 3 percent). Change in control status was unrelated to weight gain or loss. These results occurred in a generally compliant group, since the "kept-appointment" rate was 85 percent, and 92 percent of the hypertensive diabetics had their blood pressure consistently controlled to less than 160/95 mmHg.

This study indicated that implementation of a management and education protocol which follows American Diabetes Association guidelines was not sufficient to alter glycemic status in the participating NIDDM population. The active patient population of 1991 showed blood glucose levels similar to

those in the previous analysis (that is, 25 percent in good control, 36 percent in fair control, and 39 percent in poor control).

Patient education. Evaluation of the patient education program has included both measures of knowledge gained by the patient during the education process and changes in blood glucose values and weight after participation in the program. From 1987 to 1992, 1,881 patients participated in the classes, 52 percent of whom completed the sessions described earlier. Posttest results for patients completing the sessions show an average increase of correct pre-post class responses to diabetes-related questions from 65 percent to 85 percent. Although classes are conducted in Spanish for monolingual Hispanic patients, the knowledge level that they achieve is less than that of English speakers (58 percent versus 72 percent at the posttest). The difference in knowledge level achieved between Spanish language and English language groups is statistically significant ($P < .05$).

It was not possible to include a post-education class behavioral assessment as part of the evaluation plan due to limited resources. However, as discussed earlier, the results of a study of the effect of class attendance on physiological parameters (that is, weight and blood glucose) were not significant. Research results reported by others on the relationship between knowledge and compliance with treatment of chronic disease behavior have not been consistent (20-22). The knowledge tests were administered to ensure that learning objectives were achieved and to identify areas in which instruction needed to be modified.

A 1991 assessment of the possible effect of patient education on changes in the weight of class participants revealed a nonsignificant decrease of 3 percent (from 62 percent to 59 percent above ideal body weight). This compared with no decrease for nonparticipants, who weighed an average of 56 percent more than ideal body weight. In general, the education and treatment programs have had little impact in altering this high level of obesity, even though in 1992 there was a slight downward trend to 53 percent more than ideal body weight for the entire diabetes population.

Detection of visual impairment by primary care physicians. As a part of the quality assurance protocol for this program, routine assessments began 1 year after the initiation of the program. The assessments were intended to test the level of proficiency and knowledge of the physicians who conduct di-

Table 4. Fasting plasma glucose (FPG) levels for 274 patients pre- and 1-year post-protocol implementation

FPG level	FPG value (mg per dl)	Pre-protocol (percent of patients)	Post-protocol (percent of patients)
Good.....	<140	25	27
Fair.....	140-200	43	37
Poor.....	>200	32	36

lated eye examinations in the community health centers. The 1988 assessment required that physicians examine dilated eyes of a representative group of retinopathy cases commonly found in NIDDM populations (23). The eyes of 10 patients were examined by 22 internists and family practitioners using direct ophthalmoscopy as routinely done in the community health centers. The results showed an average rate of correct identification of fundus abnormalities of 65 percent and an average rate of 77 percent correct identification of no abnormalities (or 23 percent false positive). The average correct referral rate was 83 percent for all abnormalities.

The 1990 assessment required that physicians view slides and indicate on a questionnaire if the slide showed an eye with normal fundus, nonproliferative retinopathy, or proliferative retinopathy. The results showed that, of the 25 physicians participating, there was 79 percent correct identification of proliferative retinopathy and 77 percent correct identification of nonproliferative fundus abnormalities.

The 1991 assessment required that the 16 physician participants (11 participated in the 1990 study) view photographs that were different but representative of fundus abnormalities and normal fundus. These photographs were different from those used in previous assessments. The results showed 95 percent correct identification of proliferative retinopathy and 86 percent correct identification of nonproliferative retinopathy. The average scores continue to increase as the physicians have more opportunity for experience and instruction.

Peer review of charts. As a part of the quality assurance protocol for the HCHD Community Medicine Service, peer review of charts is routinely conducted by physicians to determine the appropriateness of referrals for diabetes-related eye disease and of treatment of hypertension and ischemic heart disease on a 10 percent sample of NIDDM patients. The most recent results showed that (a) 88 percent of the patients reviewed who re-

quired a dilated eye examination (based on the protocol) received an examination and, of those being referred to an ophthalmologist, 85 percent were referred appropriately; (b) 83 percent of the patients with hypertension received the appropriate medications and dosage; and (c) 92 percent of the patients with ischemic heart disease received the appropriate medications and dosage.

Conclusions

Prevention of visual impairment. Public health care settings should use the resources of ophthalmologists, optometrists, and primary care physicians to control effectively diabetic retinopathy and prevent potential blindness. Ongoing measures of the proficiency of primary care physicians in screening and detection of diabetic retinopathy show a sufficient level of sensitivity and specificity to be a routine part of the comprehensive care management for patients with adult-onset diabetes mellitus. Other studies conducted to assess the ability of nonophthalmologists to screen patients for diabetic retinopathy show that, if appropriately trained, these professionals can make referral decisions at an acceptably low risk of error (24–26).

The American Academy of Ophthalmology is committed to working with and educating other physicians and allied health professionals who assist ophthalmologists to ensure early detection of diabetic retinopathy and timely delivery of state-of-the-art ophthalmologic care as a part of their project, “Elimination of Preventable Blindness from Diabetes by the Year 2000” (27). Also, the National Eye Institute, National Institutes of Health, is sponsoring a National Eye Health Education Program designed to inform people with diabetes about the importance of dilated eye examinations to detect retinopathy and prevent blindness (28).

Prevention of foot problems. Using standardized protocols for foot care screening, referral, and education, the Houston DCP has more than doubled the yearly rate of comprehensive foot examinations of high-risk NIDDM patients. Even though it is still too soon to document the effect of the increased lower extremity screening and treatment, experience of others has shown that at least 50 percent of nontraumatic diabetes-related amputations are prevented through such protocols as that used in the Houston DCP (29). Primary care physicians, podiatrists, orthopedic and vascular surgeons, and other members of the health care team should work

together closely to provide timely comprehensive foot examinations and followup to all high-risk NIDDM patients.

Cardiovascular risk factors prevention and control.

From the experience of the HCHD community health centers and other studies (3), control of hypertension to less than 160/95 mmHg can be readily achieved using recommended treatment approaches. However, to achieve a blood pressure of less than 140/90 mmHg for most patients will require additional efforts to identify methods of achieving lower levels of systolic pressure that are practical, economically feasible, and acceptable to patients. Also, there needs to be more emphasis on decreasing non-HDL cholesterol levels as well as on hypertension, mainly through more aggressive diet and exercise programs, cessation of smoking, and selective administration of insulin.

Patient education. Pretest and posttest scores from patient education sessions consistently show gains in correct answers to questions regarding diabetes. However, pilot studies of the Houston DCP (as well as results from other studies) show that most low-income populations do not have the understanding, skills, and beliefs necessary to empower themselves to manage their diabetes (30). This program has utilized almost all known available resources to develop a program to comply with most national standards. However, the results of studies of the blood glucose and weight control, as well as patient and professional knowledge and beliefs, reveal the need for more effective models to improve self-management by NIDDM patients.

The HCHD patients with NIDDM have displayed persistent confusion regarding symptom interpretation, treatment, and prognosis of NIDDM and IDDM (31). Patients lack fundamental understanding of basic physiological concepts associated with diabetes (for example, blood sugar, calories, cholesterol, fat, hypoglycemia) which are necessary to integrate the material presented in teaching sessions (31). Effective education of non-English speaking patients as well as patients with little education requires more effort and resources and modification of standard teaching approaches.

The average years of schooling completed by Hispanic patients in our setting is 6.5 years, compared with 9.7 years for African Americans, and 10.0 years for whites. Spanish-speaking patients have been found to score consistently lower than English-speakers on posttests of the group education program. Possible explanations for this obser-

vation are that Spanish-speaking patients have had less exposure to health information about diabetes through other channels, the lower educational level of Spanish-speaking patients was not fully addressed in the teaching materials (for example, the statement "sugar is stored in fat cells" is meaningless if the patient has never heard the word "cell" used in a biological context), and second- or third-generation Hispanic personnel assigned to teach patients in Spanish may not be fluent enough to transmit information effectively to the monolingual Spanish-speaking patient at an effective level of communication. The fact that many Spanish-speaking patients use English words abundantly but pronounce them poorly compounds the severity of the communication problem.

Diet modification and physical activity. There is strong and consistent evidence that diet modification and appropriate physical activity have substantial benefits for the control of glycemia, reduction in the need for antidiabetic drugs, and reduction in a cluster of cardiovascular risk factors (32). Even though the molecular and biochemical mechanisms involved in the etiology of glucose intolerance, hypertension, dyslipidemia, upper-body obesity, and atherosclerosis are not fully understood, weight reduction and appropriate physical activity should be important parts of an integrated approach to the primary prevention of NIDDM, since they reduce insulin resistance and the levels of some of the other risk factors for coronary artery disease (33). More intensive diet modification interventions than we have been able to accomplish with the Houston DCP will be necessary to achieve reductions in blood glucose levels. Also, behavior modification in physical activity is a major challenge for NIDDM patient education programs, particularly for low-income, minority populations.

Psychosocial issues. To improve the health behaviors of the target population, diabetes specialists need to educate health care professionals as well as patients about the principles and techniques of behavior modification, along with diet and exercise requirements (34). There is need to develop visual, interactive training aids which ensure that patients internalize a functional mental model of the metabolic and cardiovascular processes that they must monitor and control (31,35). One possible reason for lack of patient compliance with recommended treatment is that most traditional education models for patients with diabetes do not help patients to develop such a functional model. Public health care

programs for persons with diabetes and associated cardiovascular manifestations will only be effective if a practical and economically feasible program of diet and exercise can be recommended by health care professionals, and the program can be identified by the patient as important, fulfilling, practical, and supported by family and friends.

Challenges for DCPs in public health care settings.

The Houston DCP has demonstrated significant gains in screening, detection, and treatment of diabetes-related visual impairment, foot problems, hypertension, and patient knowledge. However, the Houston DCP as well as other similar programs throughout the United States need to be more aggressive in substantially increasing the number of persons being screened and treated for diabetes-related complications. Also, these programs need to demonstrate more significant improvement in patients' blood pressure, plasma lipids, and plasma glucose, as well as increased levels of physical activity, and smoking cessation.

One of the major barriers to translation of new knowledge into the prevention and control of diabetes-related manifestations is insufficient primary care resources. The increasingly scarce dollars for health care are disproportionately devoted to tertiary and high technology medicine, whereas in public primary health care settings, physicians and staff are stretched way beyond reasonable limits to provide even the most basic primary care.

The shortage of health care professionals in the community health care settings challenges us to improve the efficiency of available health care resources by increasing the participation of nurse specialists in the patient care process in a manner appropriate to their education and expertise. Several programs have demonstrated the importance of the team approach to diabetes care and, in particular, to the active involvement of nurse specialists as the patient's primary professional contact (36-39). At the 1991 International Diabetes Federation Congress, Dr. John Turtle reported on a program at Royal Prince Albert Hospital, Australia, where nurse care specialists provide very effective individualized and community-based care at much lower cost than specialist physicians.

In addition to receiving professional treatment and support, patients with diabetes must develop and use a wide array of psychosocial abilities to be productive. Since it has been estimated that 95 percent of all diabetes care is delivered by the patients themselves, the National Guide to Clinical Preventive Services emphasizes the importance of

clinicians practicing primary prevention in “shifting the locus of control to the patient,” which will require developing new skills “in helping to empower patients and in counseling them to change certain health-related behaviors” (40).

To accomplish the challenges for the DCPs and all public primary health care settings during the 1990s without creating an unbearable financial burden on the patient or the taxpayer, we must work to increase efficiency and bring additional resources into the public sector. This will require collaboration of all health care professionals in constructive and imaginative ways through unselfish commitment toward common goals.

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Integrating Behavior and Intention Regarding Mammography by Respondents in the 1990 National Health Interview Survey of Health Promotion and Disease Prevention

WILLIAM RAKOWSKI, PhD
 BARBARA K. RIMER, DrPH
 SHARON A. BRYANT, PhD

Dr. Rakowski is Assistant Professor of Medical Science, Department of Community Health, and Senior Investigator, Center for Gerontology and Health Care Research, Brown University; Dr. Rimer is Director, Cancer Control Research, Duke Comprehensive Cancer Center, Duke University Medical Center in Durham, NC; and Dr. Bryant is Minority Affairs Coordinator at the Rhode Island Department of Health, Providence. She was a Post-Doctoral Fellow in the Center for Gerontology and Health Care Research, Brown University, when work on this paper began.

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Tearsheet requests Dr. Rakowski, Box G-A405, Brown University, Providence, RI 02912, telephone 401-863-3263.

Synopsis

Achieving and maintaining high rates of screening mammography are major public health priorities. This report examines data from the 1990 National Health Interview Survey of Health Promotion and Disease Prevention on the utilization of mammography among women ages 40-75.

Results show that progress is being made in some areas—57.7 percent of women “ever had” a mammogram; 50.3 percent, in previous 2 years. However, those not having repeated regular screening appear to be a sizable proportion. Only 28.6 percent of women ages 40-75 had been both screened on the recommended age-specific schedule and expressed an intention to continue screening; another 29.2 percent indicated no intention to have a mammogram in the near future.

Income, clinical breast examination, and Pap (Papanicolaou's) test, having no regular source of care, region of the country and residential variables, smoking status, not exercising, not knowing how to do breast self-examination, and race were among the variables having the strongest associations with mammography status. Several groups in the population therefore remain at risk of not receiving regular screening.

The combination of mammography status to date and future intention to have the examination provides an important perspective on efforts to reach public health screening objectives and appears to provide a strategy for targeting interventions.

ACHIEVING AND MAINTAINING high rates of regular screening mammography are among the many public health challenges currently being pursued by researchers and by virtually all health agencies.

Eleven major medical organizations, including the American Cancer Society (ACS) and the National Cancer Institute (NCI), recommend that women ages 40-49 get mammograms every 1 to 2 years,